HUAWEI

Huawei Visionaries Summit

PV + ESS Solution




One-Fits-All 2.0

Huawei One-Fits-All Solution 2.0
Evolving from Lower LCOE to Higher LBOE

One-Fits-All Solution 1.0

Lower LCOE

One-Fits-All Solution 2.0

Higher LBOE*

**LBOE: Levelized Benefit of Electricity*



Proactive Safety | **Premium Quality** | **Higher Profitability** | **One-Fits-All Capability**

Huawei One-Fits-All C&I Lite Solution

Safe and Reliable

- ESS pack level **5-layer** safety protection
- Up to 15-year warranty
- Exclusive **A+ cells** (industry's unique)

Flexible configuration

- All-temp. Ready **-20 ℃ ~ +55 ℃**
- Plug-and-play ESS design
- New and old pack mix quick expansion

Small-scale C&I

PV 75~200 kW ESS 21~165.6 kWh



Inverter Optimizer SmartLogger



50K/115K/150K MB0-25K MERC SmartLogger3000A



LUNA2000-**7/14/21**-S1

Residential

PV 25~75 kW ESS 7~100kWh



Inverter Optimizer SmartAssistant



MB0-25K MERC SA4H-A02

One-fits-all

- Battery-ready for **existing PV sites**
- Applicable to **residential scenarios**
- C&I + Residential Inverter Hybrid

Superb experience

- **<29dB** fan-less operation
- **AI** empowered FusionSolar
- Leading APP user interface

>10GWh

Global Residential ESS Shipment

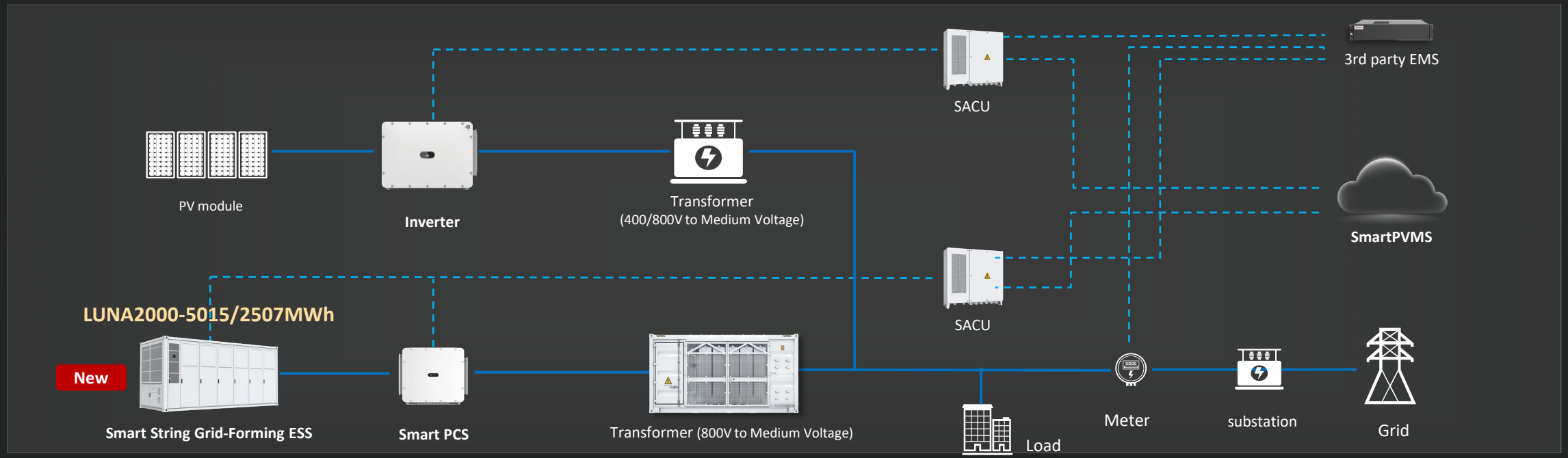
No. 1

Cumulative Residential **ESS** Shipment

"0" accidents

Caused by Huawei ESS

C&I Max Solution (on-grid only)



Higher Profitability

Better investment, ROI increased by 7.7%

Proactive Safety

Proactive safety by C2G

From cell to grid

Smart O&M

O&M efficiency increased by > 50%

C&I One-Fits-All Solution:
From Lite to Max, Towards a Green and High-Quality Future

Proactive Safety

- Directional gas exhaust / top explosion venting, unique ESS safety design
- 5ms shutdown exclusive 5-level ESS protection
- 15ms shutdown unique DC ground short circuit protection

Premium Quality

- Automotive-grade cooling system with dual power supply protection
- 15,000+ hours verified in 5 extreme real site environments
- 10-year coolant replacement-free, longer lifespan



Cloud SmartPVMS

AI Scheduling SmartDesign

PV Smart String Inverter

ESS C&I Hybrid Cooling Grid Forming ESS

Charger Liquid-cooled Charger



Industry's Largest Power C&I Inverter, 150K

30~150K



World's 1st C&I Smart Hybrid Cooling ESS NEW

107/161/215/241kWh (26 New Expansion)



Industry's 1st "5-in-1" Smart monitor & Controller NEW

SmartMGC5000B



720kW Main Unit with 180/480kW Chargers

Max 12 Guns

Higher Profitability

- 5% RTE efficiency improvement @ exclusive air-liquid intelligent cooling
- 2% available capacity enhancement @ exclusive pack-level optimization
- 2% SOH enhancement @ unique dual-circuit cooling design

One-Fits-All

- 20ms on/off grid seamless switching
- Thdi < 1.5% superior power quality, compatible across all industries
- 2-hour rapid deployment, factory-prefabricated for simplified installation

Fusionsolar

New-Generation **SUN2000-30/40/50K-MC0**

Huawei Smart PV Controller



Higher Energy Yield

- MPPT high-current design, compatible with high-current modules* New
- Built-in PID recovery at night, 3% higher system energy yield
- PV module-level optimization, 5%–30% higher yield**

Proactive Safety

- DC Type I+II lightning protection New
- Unique DC-to-ground protection, cutting off short-circuit faults
- Industry-leading AFCI solution, with a detection distance of 450 m New

Long-term Reliability

- 10-year product evolution, 99.999% reliability
- Optimizers 3x more reliable than the industry average

Simplified O&M

- Device-level -> Module-level insulation detection, 6x higher precision
- Plant-level -> Module-level power generation monitoring, high-precision module fault diagnosis and locating** New

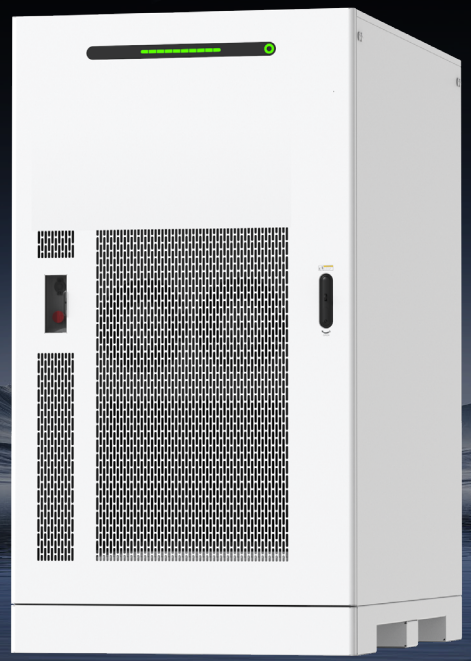
*SUN2000-50K-MC0 model support

**Needs to be implemented with MERC optimizer.

Huawei One-Fits-All Solution 2.0

Lower LCOE

Lower generation cost per kWh



Higher LBOE*

Higher value per kWh consumption

LUNA2000-241-2S1

*LBOE: Levelized Benefit of Electricity

Global POC Proving 5% Higher RTE, Revenue Improved 15.2K USD/ESS In a Decade

Hybrid Cooling System enhance efficiency

ESS efficiency related factors

51%

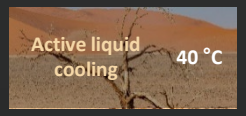
40%

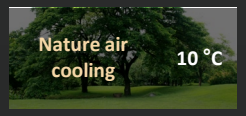
Cable 9%

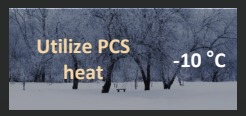
Hybrid cooling system

- Smart temperature route
- Intelligent algorithm









Electrical circuit optimization

PCS

- New gen SiC IGBT
- High-efficiency modulation algorithm

Pack

- Bi-directional balanced topology
- Efficiency improved by better heat dissipation

* RTE: round trip efficiency

Improved revenue and Global POC Proof

30%
Auxiliary power consumption

91.3%
Highest RTE in the industry

87%
Average RTE in industry

+ 15.2K USD
Revenue increased per ESS in a decade

Test results exceed claims worldwide

93.1%
by Uni Pretoria @ South Africa
Single-cycle, 0.25C

92.0%
by VDE @ Germany



Single-cycle, 0.25C

92.39%
by CNAS @ China



0.25C, 23°C~28°C

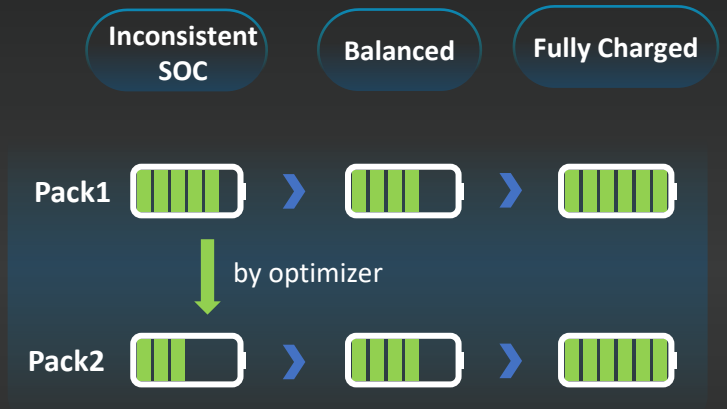
Global POC Proving 100% DOD by Unique Pack Optimizer, Revenue Improved 5.6K USD/ESS in a Decade

Cask Principle



Volume decided by shortest wood plate

Optimizer: Eliminates Cask Effect, Maximizes Capacity

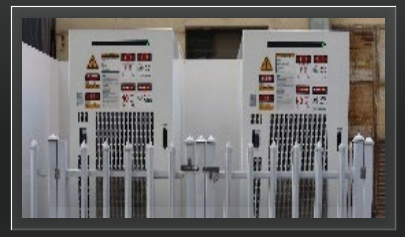


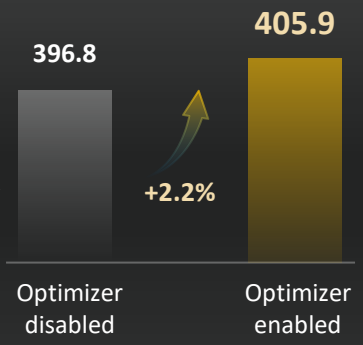
100%

DOD, depth of discharge

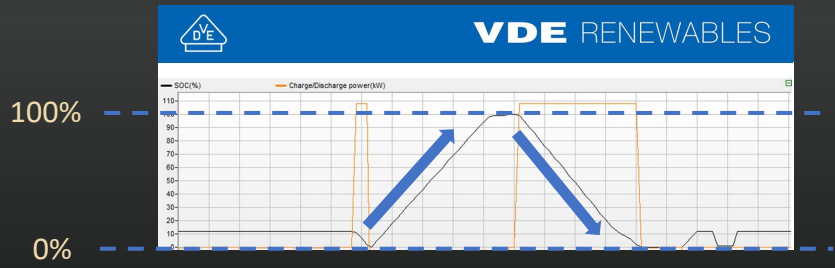
Testing Reports from Commercial sites

Report 1: 100% DOD validated @China Zhejiang





Report 2: 100% DOD validated by VDE @Germany

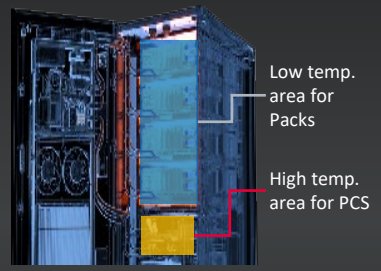


2% Higher SOH and Revenue Improved by 6.9K USD/ESS in a Decade

Unique Heat Dissipation Design

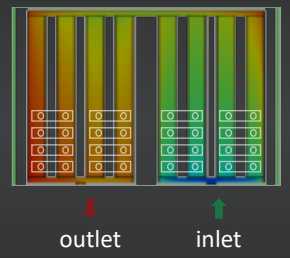
3°C ↓
Cell temperature rise

< 2.2°C
Cell temperature difference



High & low temp. zone isolation
PCS liquid cooling

Industry
U-shaped flow path



Multiple pipes connection
high flow resistance

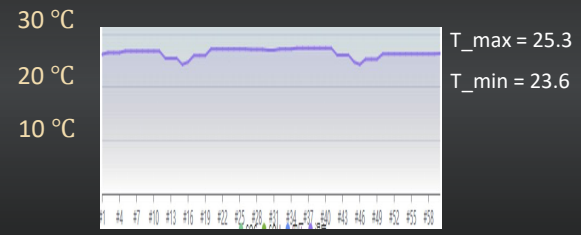
Revenue to be Improved as Less Degradation

↑ **2%**
10 years SOH average increase
2 cycles / day

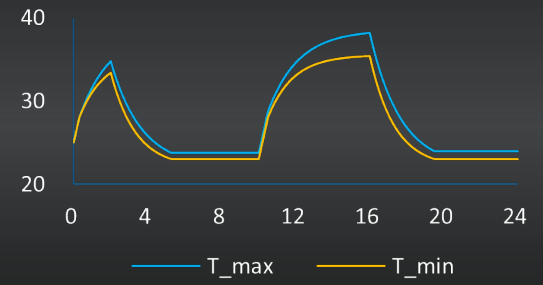
+ 6.9 K USD
Revenue increased per ESS in a decade

Testing Reports from Commercial sites

Report 1: Cell Temp. Difference
1.7 °C @ Hunan China



Report 2: Cell Temp. Difference
1.8 °C @ Zhejiang China



Higher Power Quality, Ensuring Stable Business Operation

Higher power quality by intelligent algorithm

Intelligent algorithm



Suppressing the impact of harmonics

Higher power quality

	Huawei		Industry
THDi	≤1.5%	VS	≤3%
THDu	≤2%		≤3%

Global Applications



Semiconductor Manufacturing, China

2.1MWh, on-grid

Verified PCS THDi: **1.3%**



Copper foil Manufacturing, China

10.1MWh on-grid

0 Production Disruption

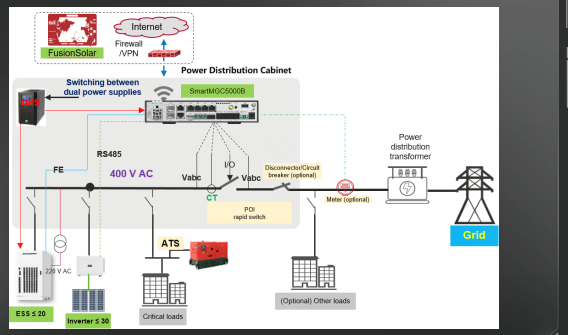


Business park, South Africa

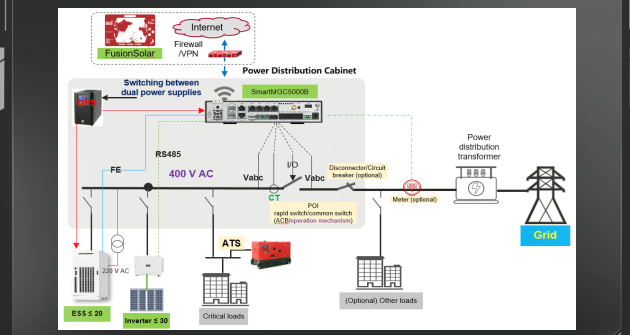
1MWh, off-grid

PCS withstand THDi **48%** generated by LED devices

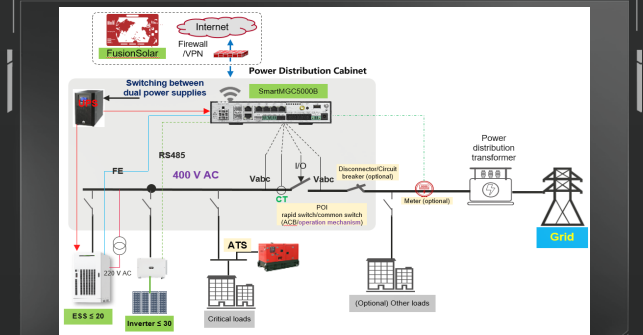
On/Off-gird Solution updated



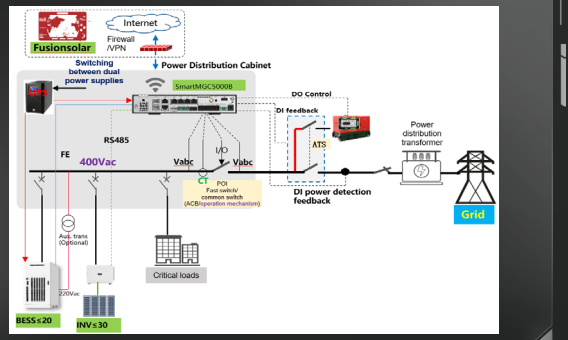
1. Low-voltage seamless on/off-grid (20ms)



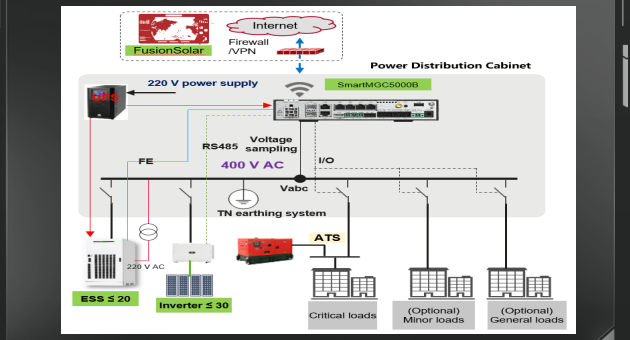
2. Low-voltage seamless on/off-grid (60ms / 150ms)



3. Low-voltage seamed on/off-grid (backup)

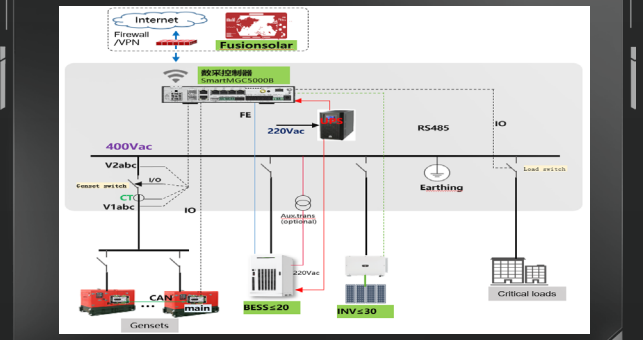


4. Low-voltage On/Off-grid (PV-ESS-Genset parallel operation)



5. Low-voltage Off-grid

(No Genset Control)



6. Low-voltage Off-grid (PV-ESS-Genset parallel operation)

20ms Seamless Switch, Uninterrupted Protection for Critical Equipment

Effective on/off-grid seamless switch

Huawei system innovation

- <3ms fast and direct sampling
- <1ms switchover command sending
- <3ms PQ to VSG mode change

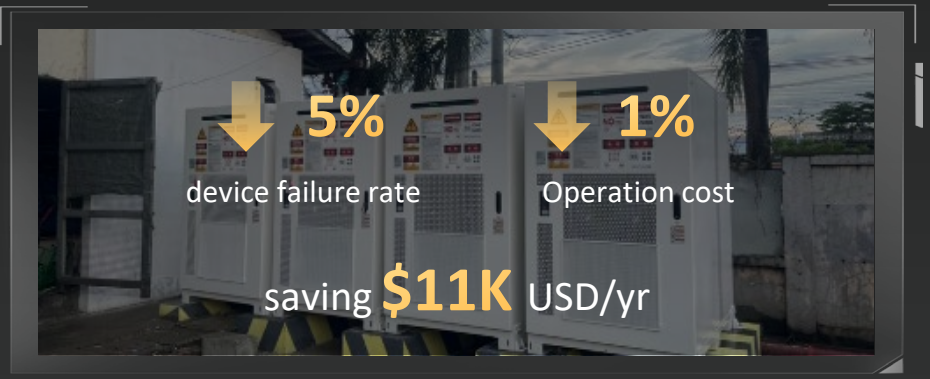
Huawei	Industry
< 20ms Grid outage	**20 ~ 50ms**
0ms Near-end Open	• **Low** success rate under **frequent switching** • **Only test** near-end open, instead of grid outage

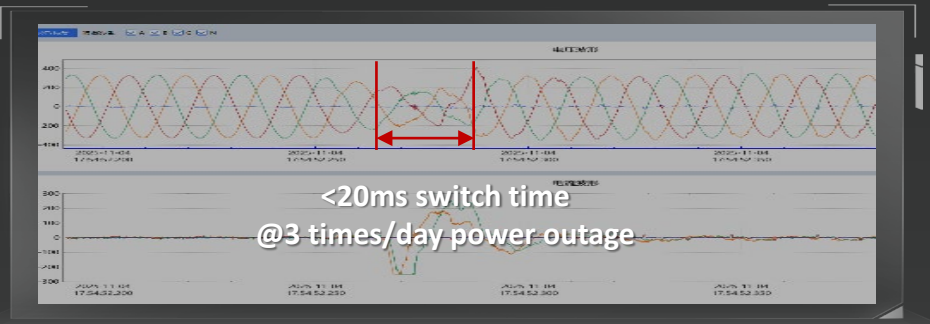
VS

Global Applications

Garment factory @ Myanmar

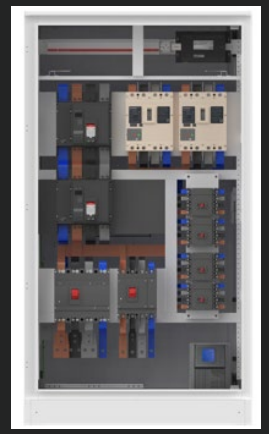
20ms seamless protect the raw material and continuous manufacturing





Centralized deployment products and distributed deployment products support different load capacities





Product Application Scenarios

Standard Solution Scenarios

- **400V PV+ESS Grid-Connected and Off-Grid Switching Standard Solution.**

Typical Non-Standard Solution Scenarios (Customization Required)

- PV-ESS-DG parallel operation, and DG controlled by RS485 signal.
- Third-party EMS for microgrid controller.
- Mixed use of third-party inverters.
- Qty of the switches to be changed.

		L80 Series	L150 Series	L300 Series	Combination Series
	Qty of PowerFusion cabinet	1 cabinet	1 cabinet	1 cabinet	> 1 cabinet
	Fast grid-connected and off-grid switching for PV, ESS, and grid	✓	✓	✓	Under development. It will support load capacity more than 350 kW and less than 1500 kW (based on non-impulsive load statistics).
	Seamless grid-connected and off-grid switching for PV, ESS, and grid.	✓	✓	✓	
	PV-ESS-DG parallel operation, and DG controlled by DO signal	✓	✓	✓	
	PV-ESS-DG parallel operation, and DG controlled by RS485 signal	✓	✓	✓	
	Maximum self-consumption	✓	✓	✓	
	TOU	✓	✓	✓	
	Peak shaving	✓	✓	✓	
	Grid-tied and off-grid switching time ①	20 ms	20 ms	20 ms	
	Load backup capacity ②	80 kW	150 kW	300 kW	
	Qty of LUNA2000-241/215/161/107	1	2	4	
	SUN2000-50/100/150K	1*MCCB 250A	1*MCCB 630A	1*MCCB 1000A	
	Fast switch	250 A	630 A	1000 A	

Note:

① **Fast switch is required for 20 ms switching solution**, and the switching time is 60 ms or 150 ms when the ACB switch is used.

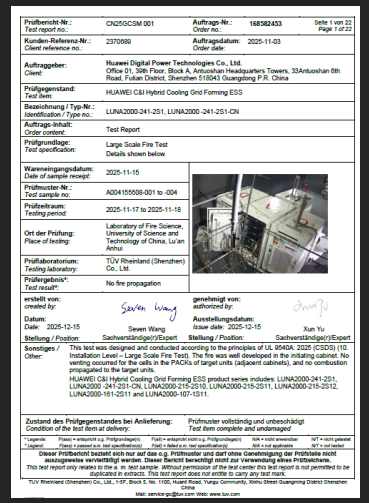
② 80kW/150kW/300kW refers to the maximum load capacity of the PCS for **general loads** in off-grid scenarios. Derating is required when there are impact loads such as motors.

Intrinsic Safety: Passing the World's Most Stringent Large-Scale Fire Test

Industry's 1st Large-Scale Fire Test

Based on

the Latest **UL9540A:2025** Standard



Prüfbericht-Nr.: CN25GCSM 001 | Auftrags-Nr.: 168582453 | Seite 1 von 22
Test report no.: | Order no.: | Page 1 of 22

Kunden-Referenz-Nr.: 2370589 | Auftragsdatum: 2025-11-03
Client reference no.: | Order date:

Auftraggeber: Huawei Digital Power Technologies Co., Ltd. Office 01, 30th Floor, Block A, Antuoshan Headquarters Towers, 33Antuoshan 6th Road, Futian District, Shenzhen 518043 Guangdong P.R. China
Client:

Prüfgegenstand: HUAWEI C&I Hybrid Cooling Grid Forming ESS
Test item:

Bezeichnung / Typ-Nr.: LUNA2000-241-2S1, LUNA2000 -241-2S1-CN
Identification / Type no.:

Auftrags-Inhalt: Test Report
Order content:

Prüfgrundlage: Large Scale Fire Test
Test specification: Details shown below

Wareneingangsdatum: 2025-11-15
Date of sample receipt:

Prüfmuster-Nr.: A004155508-001 to -004
Test sample no:

Prüfzeitraum: 2025-11-17 to 2025-11-18
Testing period:

Ort der Prüfung: Laboratory of Fire Science, University of Science and Technology of China, Lu'an Anhui
Place of testing:

Prüflaboratorium: TÜV Rheinland (Shenzhen) Co., Ltd.
Testing laboratory:

Prüfergebnis*: No fire propagation
Test result*:

erstellt von: Seven Wang | genehmigt von:
created by: | authorized by:

Datum: 2025-12-15 Seven Wang Sachverständige(r)/Expert | Ausstellungsdatum: 2025-12-15 Xun Yu Sachverständige(r)/Expert
Date: | Issue date: | Stellung / Position:

Sonstiges / Other: This test was designed and conducted according to the principles of UL 9540A: 2025 (CSDG (10. Installation Level – Large Scale Fire Test). The fire was well developed in the initiating cabinet. No venting occurred for the cells in the PACKs of target units (adjacent cabinets), and no combustion propagated to the target units.
HUAWEI C&I Hybrid Cooling Grid Forming ESS product series includes: LUNA2000-241-2S1, LUNA2000 -241-2S1-CN, LUNA2000-215-2S10, LUNA2000-215-2S11, LUNA2000-215-2S12, LUNA2000-161-2S11 and LUNA2000-107-1S11.

Zustand des Prüfgegenstandes bei Anlieferung: Prüfmuster vollständig und unbeschädigt
Condition of the test item at delivery: Test item complete and undamaged

* Legende: Pass() = entspricht o.g. Prüfgrundlage(n) | Fail() = entspricht nicht o.g. Prüfgrundlage(n) | N/A = nicht anwendbar | N/T = nicht getestet
* Legend: Pass() = passed o.m. test specification(s) | Fail() = failed o.m. test specification(s) | N/A = not applicable | N/T = not tested

Dieser Prüfbericht bezieht sich nur auf das o.g. Prüfmuster und darf ohne Genehmigung der Prüfstelle nicht auszugsweise vervielfältigt werden. Dieser Bericht berechtigt nicht zur Verwendung eines Prüfzeichens.
This test report only relates to the a. m. test sample. Without permission of the test center this test report is not permitted to be duplicated in extracts. This test report does not entitle to carry any test mark.

TÜV Rheinland (Shenzhen) Co., Ltd., 1-5F, Block 5, No. 1100, Huanli Road, Yuegu Community, Xinhu Street Guangming District Shenzhen China
Mail: service-gc@tuv.com Web: www.tuv.com

We Test What We Sell

- **100%** mass-production models tested in industry's most demanding verification environment

Worst-Case Upon Ignition

- Induced simultaneous thermal runaway in **all 60 Cells** at **100% SOC**

*pack-level overcharge method

No Propagation Between Units

961°C
Highest Cell Temp. of the fired ESS

45.3°C
Highest Cell Temp. of an Adjacent ESS

Heat Release Managed Rapidly

3 MW
Recorded Peak HRR*

< 3h
Combustion Lasted Only

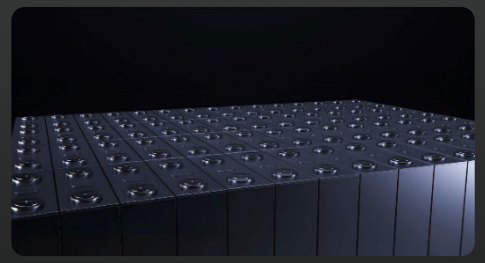
*heat release rate

State Key Laboratory of Fire Science
Test Site

Nov. 2025
Test Time

TÜVRheinland® TÜV Full Witness
Precisely Right.

Five-Level Safety Protection, Intrinsically Proactive Safety Throughout Lifespan



01 Inter-cell thermal isolation



02 All metal enclosure

03 Positive pressure oxygen blocking + directional smoke exhaust design



04 Fireproof labyrinth design



05 Enhanced cabinet fire resistance

10-in-1 Excellence
Lower Cost, Higher Values and Safer Journey per kWh

Electricity trading

Stable power supply

Lower LCOE

2 Efficiency
Unique Hybrid Cooling, 91.3% RTE

3 Utilization
Unique Pack Optimizer, 100% DOD



LUNA2000-241 Series

4 Cycle Performance
Unique Heat Dissipation, 2% Higher SOH

1 Intrinsic Safety
The 1st Large-scale fire test certification

Higher LBOE*

5 Power control
< 50 ms, faster response

6 SOC Accuracy
Higher precision for capacity trade

7 Power Quality
THDi ≤1.5%, better power quality

9 AI Intelligence
AI scheduling cases, extra revenue 20%+

8 One-Fits-All Capability
Applicable to Every Scenario

10 Stable Operation
20ms seamless switch

*Levelized **Benefit** of Electricity

HUAWEI

Thanks !

